EXAMINATION OF THE PILE BAY MAGNETITE DEPOSIT FOR POSSIBLE ASSOCIATED PLATINUM-GROUP-ELEMENTS, ILIAMNA REGION, ALASKA

By James C. Barker

* Field Report - January, 1983

U. S. DEPARTMENT OF THE INTERIOR
James G. Watt, Secretary
BUREAU OF MINES

TABLE OF CONTENTS

Page

Discussion and Summary.....

Introduction.....

Geology.....

Mineral Investigation.....

Sampling.....

References.....

ILLUSTRATIONS

FIGURE 1. Location map.....

FIGURE 2. Looking northeast from near VABM Pile.....

FIGURE 3. Bedrock geology and sample locations of the Bile Bay area.....

FIGURE 4. Intrusive breccia dike.....

TABLES

1. Analyses of magnetite-bearing pyroxenite.....

2. Rock sample analyses from the Pile Bay area.....

3. Stream sediment analyses from the Pile Bay area.....

4. Analyses of panned concentrates from the Pile Bay area.....

EXAMINATION OF THE PILE BAY MAGNETITE DEPOSIT FOR POSSIBLE ASSOCIATED PLATINUM-GROUP ELEMENTS, ILIAMNA REGION, ALASKA

By James C. Barker[1]

DISCUSSION AND SUMMARY

The Klukwan titaniferous magnetite pyroxenite deposit near Haines, Alaska has been found to contain minor amounts of platinum metals with zones of low grade copper minerals typically found in the basal portion of the ultramafics. At Pile Bay titaniferous magnetite also occurs in magnetite pyroxenite, however no similar copper enriched zones were located. Stream sediment data failed to indicate the presences of Cu, Ni or Co sulfides and analyses of panned concentrates encountered no significant PGE values. Several ultramafic rock samples contained trace amounts of Pt and Pd, however this is not unusual for ultramafic complexes.

Based on the present information, no further work appears warranted in the Pile Bay area.

INTRODUCTION

In 1964 the Pan American Petroleum Corporation, an exploration subsidiary of Standard Oil Company of Indiana, discovered and staked 497 claims over at least 7 large titaniferous magnetite deposits in the Lake Iliamna region (fig. 1). The deposits are reported to contain 1

[1] Supervisory Physical Scientist, AFOC, Fairbanks, Alaska.

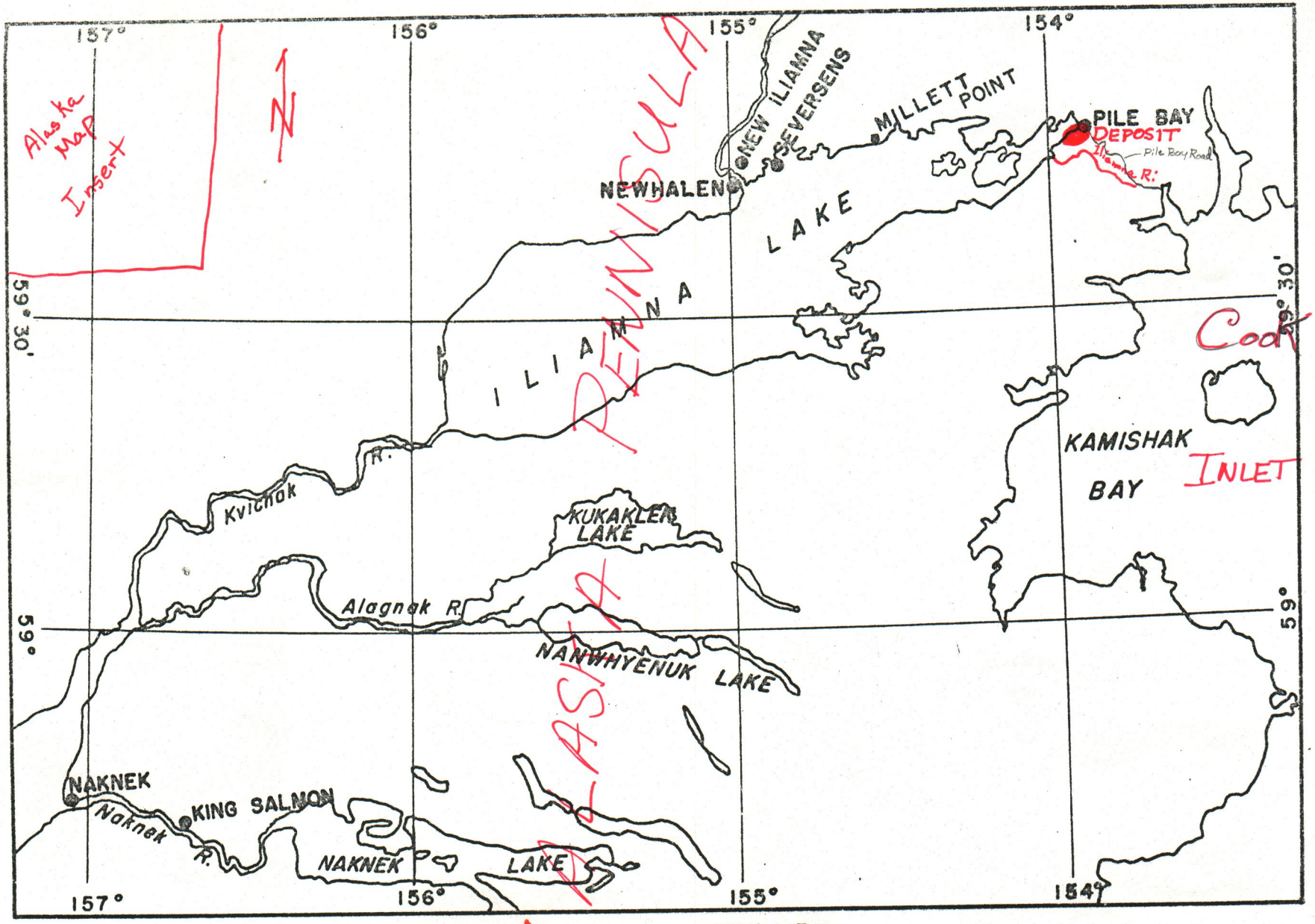

Figure 2. - Location map of Millett Point.

billion tons of recoverable iron in rock averaging approximately 15% iron as magnetite. Although the deposits were of low grade it was thought that their proximity to a deep water port coupled with nearby Cook Inlet coal deposits and natural gas resources would enable development. Competition from new foreign discoveries, and the undesirable titanium associated with the Iliamna deposits eventually caused the claims to be considered noncommercial and they were dropped in 1970.

In 1982 the U. S. Bureau of Mines examined and sampled the magnetite deposit that occurs along the southeast shore of Pile Bay (Iliamna Lake). The purpose of the investigation was to determine if platinum-group elements (PGE) were occurring within the magnetite-bearing complexes. Approximately 12 man-days were spent on the effort.

work was conducted on foot traverses from a temporary field camp. Access was by float plane to the bay. Steve Will and Dawn Alliger served as geologic field assistants.

Previous investigators have compared Pile Bay and the other magnetite deposits in the Iliamna area to the Klukwan magnetite deposit near Haines in southeast Alaska (3).[2] Recent USBM investigations of the

---

[2] Underlined numbers in parentheses refer to items listed in the references at the end of this report.

Klukwan deposit have shown that minor amounts of platinum-group elements (PGE) are associated with low-grade copper sulfide zones within magnetite-bearing pyroxenite. The objective of the present investigation was to determine if PGE occurs in similar rocks at Pile Bay.

Considerable geologic data and references pertaining to the geologic setting of the Alaska Peninsula are contained in literature

available to the public. The most pertinent and comprehensive work is the stratigraphy, structure and economic geology of the Iliamna Quadrangle, Alaska by Detterman and Reed, 1980 (2). This publication includes 1:250,000 scale geologic map(s) of the Iliamna Quadrangle and supercedes the same authors earlier compilation in 1964 (1).

The Iliamna region is similar to southeastern Alaska and consists of hills and low mountains covered with heavy timber with relatively dense undergrowth (fig. 2). Climate is cool maritime, typical of north Pacific coastal areas.

Figure 2. - Looking northeast from near VABM Pile. Terrain is hilly with continuous brush and forest cover. Abundant precipitation results in boggy conditions with thick organic accumulations in low areas.

GEOLOGY

The Pile Bay area as most recently mapped by Detterman and Reed (2) is underlain by a Jurassic complex of hornblende-biotite quartz diorite which is part of the Alaska-Aleutian Range batholith. Within the Iliamna Quadrangle the hornblende-biotite quartz diorite is known to include diorite, granodiorite, quartz monzonite, granite, and dikes of monzonite and aplite. A potassium-argon date of 156 m.y. was obtained on biotite from quartz diorite at Pile Bay (1).

Within, or in contact with the quartz diorite are inclusions and pendents of mafic and ultramafic rocks composed of hornblende, magnetite-pyroxenite and cumulate hornblende gabbro. Visible layering in the mafic rocks is defined by variations in the pyroxene and hornblende abundances. These rocks may include amphibolites derived by assimilation of mafic volcanic wall rock.

Geological observations made at Pile Bay during this investigation are shown in figure 3 and generally agree with the regional unit descriptions by Detterman and Reed. The units of magnetite-bearing hornblende pyroxenite and hornblendite (± plagioclase and pyroxene) are somewhat more restricted in extent than previously mapped (2).

Narrow dike-like zones (1-4 ft wide) of recemented intrusive breccia were observed at two locations (fig. 4). The breccia includes a mixture of clasts of mafic-ultramafic compositions. Xenoliths of similar compostion are also quite common in the quartz diorite.

Elsewhere in the Iliamna Quadrangle magnetite is a common constituent (5-20%) of the gabbroic rocks. Magnetite content of gabbro in the Pile Bay area was not observed to exceed several percent.

Figure 4. - Intrusive breccia dike.

MINERAL INVESTICATION

The principle outcrop of magnetite-bearing ultramafic rock that was examined during this investigation is exposed along low cliffs above the bay (sample location LP19283-19284). Magnetite occurs in a dike-like structure of hornblende-pyroxenite which is in turn cut by dikes of quartz monzonite. The magnetite-bearing zone is exposed for approximately 600 ft along the shore and contacts appear gradational with host units of hornblende gabbro and the granodiorite.

The highest concentration of magneitie occurs in a 250 ft long portion at the southwest end of the larger magnetite-bearing zone.

Two bulk samples of approximately 40 lb each were collected from the high-grade portion exposed along the shore. These samples represent random chip samples from sites approximatley 30 ft square. Analyses shown in table 1 were performed by the USBM Reno Research Center. No PGE were detected.

TABLE 1. - Analyses of magnetite-bearing pyroxenites[1]

Sample No.	Fe	TiO_2	Cu	S	Pt	Pd	Au	Ag
LP19283	20.1	2.16	0.015	0.05	<0.002	<0.002	<0.0004	<0.02
LP19284	17.4	1.59	0.017	0.06	<0.002	<0.002	<0.0004	<0.02

[1] Fe, TiO_2, Cu, S, reported in percent; Pt, Pd, Au, Au reported in parts per million (average of 2 determinations).

A similar magnetite-bearing pyroxenite is exposed at VABM Pile (sample location LP19285-19287). The magnetite-enriched zone (>10%) does not exceed 100 ft in width. The structure strikes southwest toward similar magnetite-bearing outcrops which occur on a point of land north of the mouth of the Iliamna River (sample location LP19295-19296).

Accessory sulfides were observed locally associated with gabbros and hornblendite of the batholith. Only pyrite and pyrrhotite were identified except at sample location LP19286 where chalcopyrite and malachite occur as small knots and pods (up to 1.5 in) with boxworks in diameter) and as occasional discrete grains. The mineralization was observed in only several coarse-grained magnetite-pyroxene hornblendite boulders found in the hilltop rubble. This site is a layered sequence (basal?) of hornblendite, magnetite, pyroxene hornblendite, pyroxenite, and gabbros which are fault-bounded immediately to the east, and gradationally vary to predominantly gabbro and diorite to the west. Slightly elevated levels of copper were analytically detected in stream sediment samples downstream of this location (LP19293-19294) but this may be attributable to pyrrhotite-bearing gabbro found as creek float.

Black sand accumulations were observed on the sand bars near the mouth of the Iliamna River. Time did not permit sampling of these, however.

SAMPLING

Analyses listed in tables 2, 3 and 4 were performed as footnoted.

TABLE 2. - Rock sample analyses from the Pile Bay area[1]

Map no.	Sample no.	Ag	Co	Cu	Ni	Ti	Fe_2O_3	Au	Pt	Pd
	LP19225							0.001	<0.002	<0.002
	LP19281	0.2	33	70	27			<0.0002	0.002	0.0003
	LP19285	0.2	39	170	22	10869	15.4	<0.0002	<0.001	<0.001
	LP19286	0.4		1650	16			<0.0002	<0.001	<0.001
	LP19287		55	260	43			<0.0002	<0.001	<0.001
	LP19288							<0.0002	<0.001	<0.001
	LP19289							<0.0002	<0.001	<0.001
	LP19292	0.1	20	110	13			<0.0002	0.001	<0.001
	LP19296		24	100	6			<0.0002	0.001	<0.001
	LP20273		22	94	16			0.002	<0.0003	<0.0003

Description

LP19225 - Angular fragments of diorite composition occasionally with pyrrhotite occurring in intrusive breccia zone.
LP19281 - Hornblendite with variable content of plagioclase up to 10%, appears to gradationally phase into the quartz diorite.
LP19285 - Chip sample across magnetite-bearing hornblende pyroxenite outcrop. Magnetite zone is approximately 250 ft wide.
LP19286 - High graded sample from boulder of magnetite-bearing hornblendite with small knots (1/8-1 in) of sulfides including pyrite and chalcopyrite with boxwork.
LP19287 - Fine-grain hornblendite with disseminated pyrite and pyrrhotite and minor malachite on fracture surfaces. Only several boulders with malachite were seen.
LP19288 - Chip sample across outcrop of pegmatitic hornblendite. Hornblende crystals up to 10 in long.
LP19289 - Small zone of coarser grain (up to 3 in) hornblende pyroxenite occurring within the principal magnetite zone.
LP19292 - Pyrrhotite-bearing gabbro with fine-grain hornblende pyroxenite xenoliths and approximately 3% magnetite.
LP19296 - Hornblendite to hornblende gabbro with approximately 1-2% iron sulfide and 5% magnetite.
LP20273 - Pyroxene gabbro with iron sulfides.

---

[1] Ag, Co, Cu, Ni, Ti reported in parts per million, Fe_2O_3 reported in percent, Au, Pt, Pd reported in oz/ton.

NOTE. - Au, Pt and Pd were analyzed by a fire assay - ICP quantitative procedure by the USBM, Reno Research Center, Reno, Nevada.
Fe was analyzed by standard assay and all other elements were analyzed by atomic absorption at TSL Laboratories, Spokane, Washington.

TABLE 3. - Stream sediment analyses the Pile Bay area[1]

Map No.	Sample No.	Ag	Co	Cu	Ni
	LP19227	<0.1	2	19	4
	LP19229	<0.1	3	15	5
	LP19262	<0.1	6	14	6
	LP19264	<0.1	4	17	4
	LP19290	<0.1	<1	9	2
	LP19291	<0.1	1	13	3
	LP19293	<0.1	1	70	3
	LP19294	<0.1	4	58	3
	LP19295	<0.1	3	21	4
	LP20271	<0.1	8	14	4
	LP20275	<0.1	9	14	6
	LP20277	<0.1	5	9	5
	LP20279	<0.1	8	13	7
	LP20282	<0.1	5	24	4

[1] Ag reported in oz/ton, all other analyses in parts per million.

NOTE. - Analyses by standard atomic absorption procedures at TSL, Laboratories, Spokane, Washington.

TABLE 4. - Analyses of panned concentrates from the Pile Bay area[1]

Map no.	Sample no.	original sample volume ft^3	weight of recovered black sand (g)	Au	Pt	Pd	Os	Ir	Ru	Rd
	LP19228	1.4	30.28	<0.001	<0.002	0.002				
	LP19230	0.5	15.34	0.001	<0.002	<0.002				
	LP19263	1.4	14.58	0.001	<0.002	0.002	N	N	N	N
	LP20272	6.3	24.65	<0.001	<0.002	0.002				
	LP20274	2.1	79.40	<0.001	<0.002	<0.002				
	LP20276	4.2	75.78	<0.0004	<0.002	0.002				
	LP20278	4.2	14.58	0.001	0.002	<0.002	N	N	N	N
	LP20281	1.4	7.66g	0.001	<0.002	0.002				
	LP19226	1.6	31.0	<0.0004	<0.002	<0.002				

[1] Au, Pt, Pd reported in oz/ton.

NOTE. - Samples were collected with a steel shovel from the centers of active stream channels. The aluvial material was screened and reduced by hand panning to black sands. Splits were made and fire-assayed followed by an ICP quantitative procedure.

N - not detected.

REFERENCES

1. Detterman, R. L. and B. L. Reed. Preliminary Map of the Geology of the Iliamna Quadrangle, Alaska. U.S. Geol. Survey Misc. Inves. Series I-407, 1964, Scale 1:250,000.

2. _____. Stratigraphy, Structure, and Economic Geology of the Iliamna Quadrangle, Alaska. U.S. Geol. Survey Bull. 1368-B, 1980, pp. B1-B86, 1 plate.

3. Herdlick, J. A., Area Director U.S BuMines. Written communication on July 21, 1967, on file at U.S. BuMines, Fairbanks, Alaska.